Armed Forces College of Medicine

AFCM

Pathology of Interstitial Lung Diseases, Pneumoconiosis and Vascular Disorders of the lung

Prof. Omnia Kamel Rizk


Good
morning

INTENDED LEARNING OBJECTIVES (ILO)

By the end of this lecture the student will be able to:

1. Define Interstitial Lung Disease (ILD)
2. Describe radiological and pathological patterns of interstitial pneumonia
3. Define pneumoconiosis
4. Discuss the pathology of different types of pneumoconiosis
5. list complications of ILD
6. Mention causes of different types of vascular lung diseases
7. Demonstrate the pathological changes of different types of vascular lung diseases

Lecture Plan

1. Part 1 (5 min) Introduction
2. Part 2 (35 min) Main lecture
3. Part 3 (5 min) Summary
4. Lecture Quiz (5 min)

Interstitial lung Disease (ILD)

Definition:

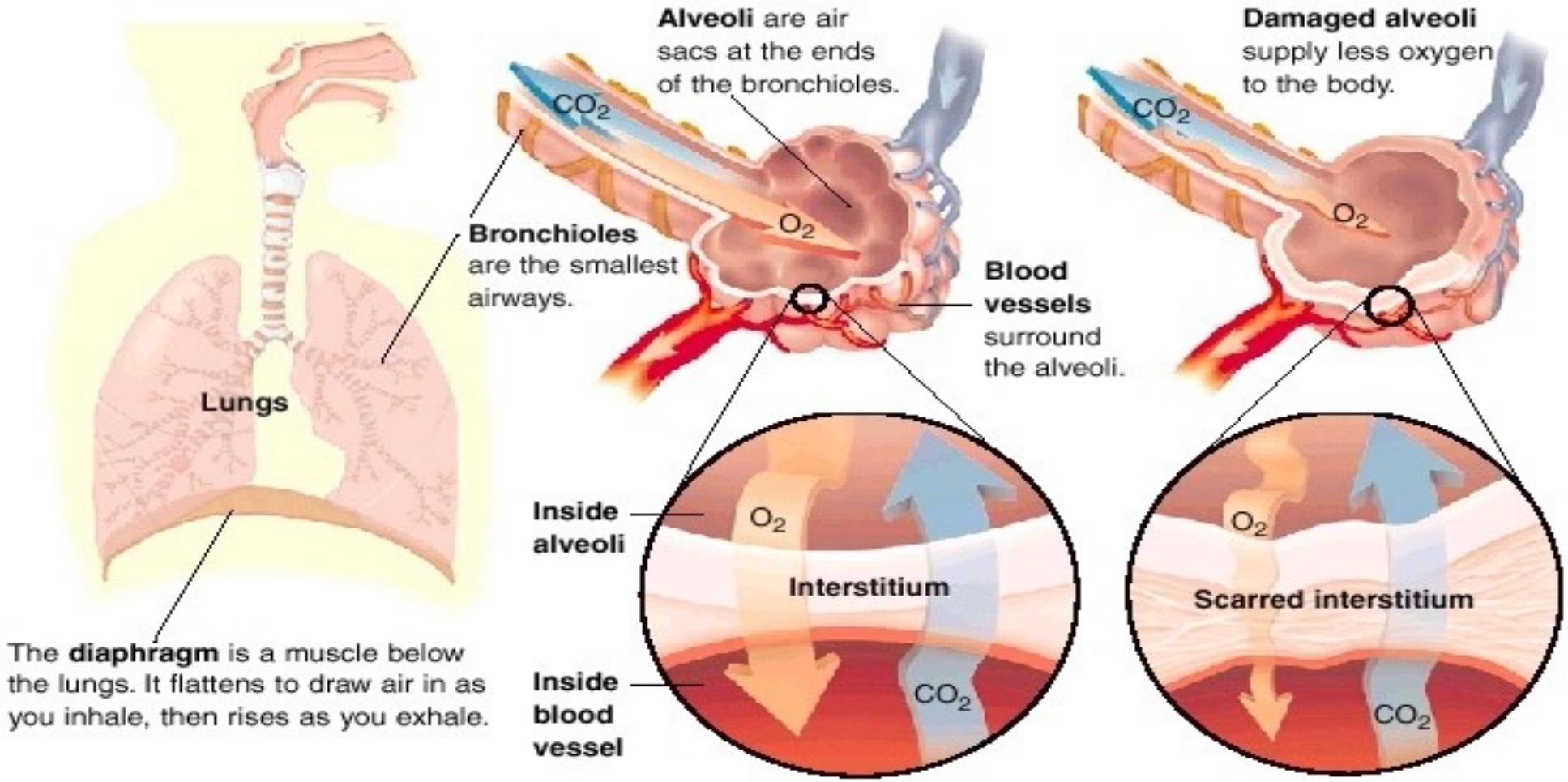
Interstitial lung disease (ILD), is a group of lung diseases affecting the interstitium of the lung (the tissue and space around the alveoli).

It concerns: a. Alveolar epithelium (Interalveolar septae)

b. Pulmonary capillary endothelium
c. Basement membrane
d. Perivascular tissue
e. Perilymphatic tissue

It may occur when an injury to the lungs triggers an abnormal healing response. Patients present with dyspnea and cough

Interstitial lung Disease (ILD)



https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwjH8-zazOPjAhUBHxoKHbcnD84QjRx6BAgBEAQ&url=https%3A%2F%2Facil.med.harvard.edu%2Finterstitial-lung-disease&psig=AOvVaw1ANxUDIOsyP1UJKMc6t0zl&ust=1564814847621488

Interstitial Pneumonia

Definition: Also known a**s (Primary atypical pneumonia or Idiopathic pulmonary fibrosis - IPF). It is a fatal disease.**

Acute febrile respiratory disease characterized by patchy inflammatory changes confined only to *pulmonary interstitium* with sparing of the alveolar cavity from the inflammatory changes.

The term atypical denotes *moderate amount of sputum and absence of consolidation.*

Causative organisms:

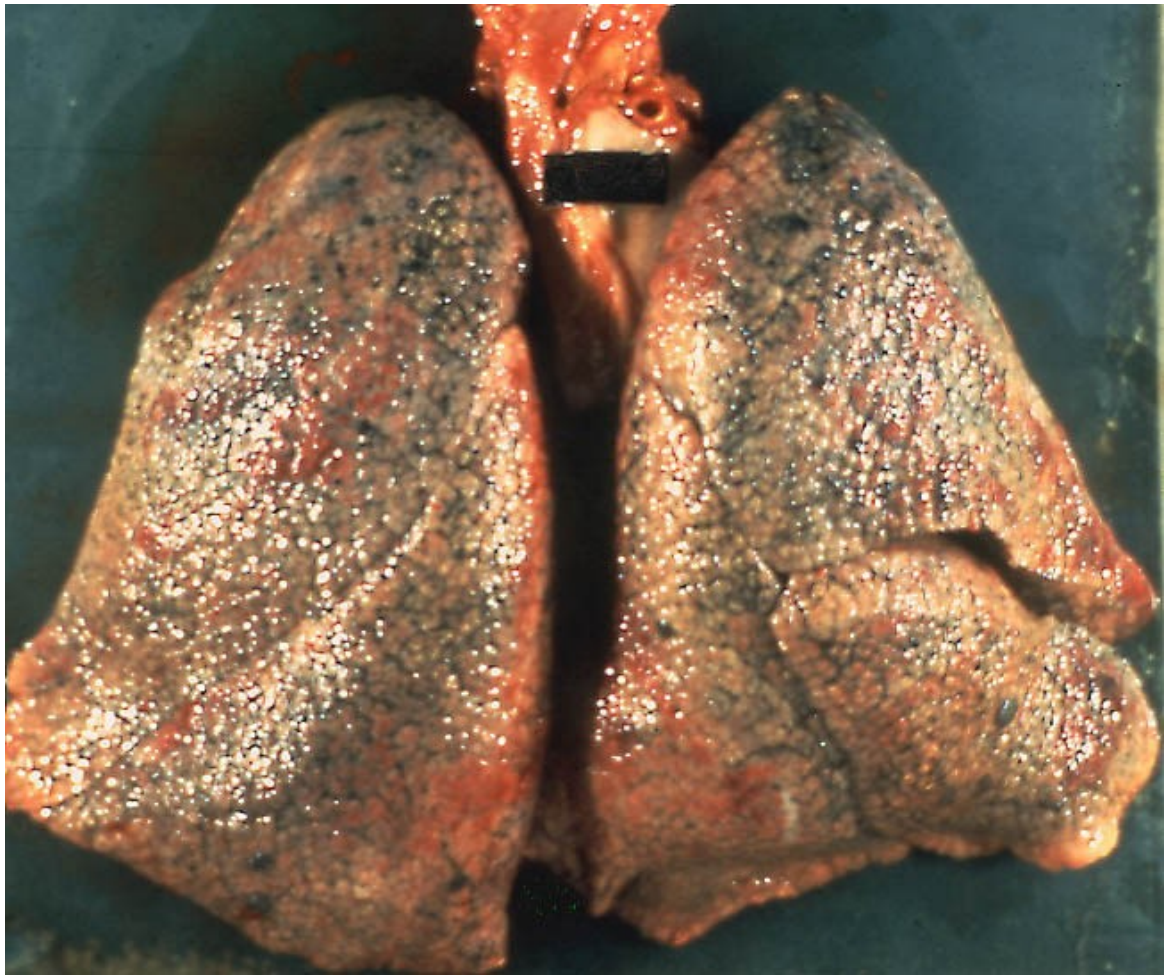
Mycoplasma pneumonia and pneumocystis carinii.

Influenza viruses types A&B, respiratory syncytial viruses (RSV) adenovirus, rubella virus, rhinovirus and varicella

Interstitial Pneumonia

Radiologically,

Honeycomb lung is the radiological appearance seen with **widespread fibrosis** and is defined by the presence of *small cystic spaces* with irregularly thickened walls composed of *fibrous tissue*



https://www.google.com/url?sa=i&source=images&cd=&cad=rja&uact=8&ved=&url=http%3A%2F%2Fwww.pathologyoutlines.com%2Ftopic%2FlungnontumorUIP.html&psig=AOvVaw2PzKY-INm0HpAUUK0w6u_6&ust=1564815737552708

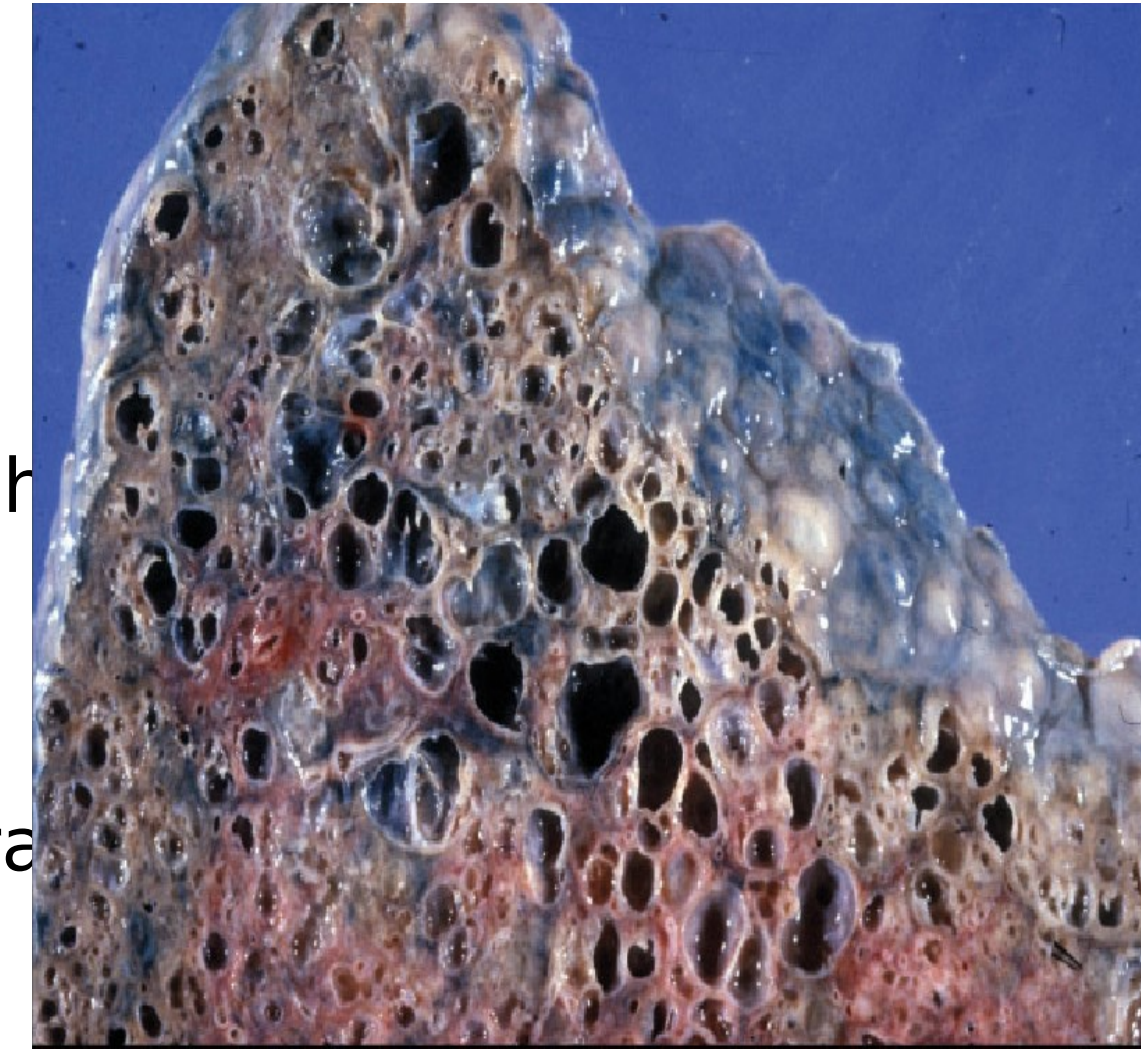
Interstitial Pneumonia

Grossly:

The lungs are:

- bulky,
- purple red and
- exudate blood stained froth wh

The process may be patchy,
may involve the whole lobe
and may be bilateral or unilatera



https://www.google.com/imgres?imgurl=https%3A%2F%2Fai2-s2-public.s3.amazonaws.com%2Ffigures%2F2017-08-08%2F0d5cc7fd7079c7a82d00afe6ae69b6fc24ba3a66%2F3-Figure2-1.png&imgrefurl=https%3A%2F%2Fwww.semanticscholar.org%2Fpaper%2Fidiopathic-pulmonary-fibrosis%253A-an-update.-Dempsey-Kerr%2F0d5cc7fd7079c7a82d00afe6ae69b6fc24ba3a66%2Ffigure%2F1&docid=mYbnBlrvnPa5mM&tbnid=2QRWHFQ3YOa6yM%3A&vet=10ahUKEwjgkMOCz-PjAhUKXsAKHaTuDIQQMwhRKBEwEQ..i&w=864&h=622&bih=595&biw=1350&q=gross%20appearance%20of%20interstitial%20pneumonia&ved=0ahUKEwjgkMOCz-PjAhUKXsAKHaTuDIQQMwhRKBEwEQ&iact=mrc&uact=8

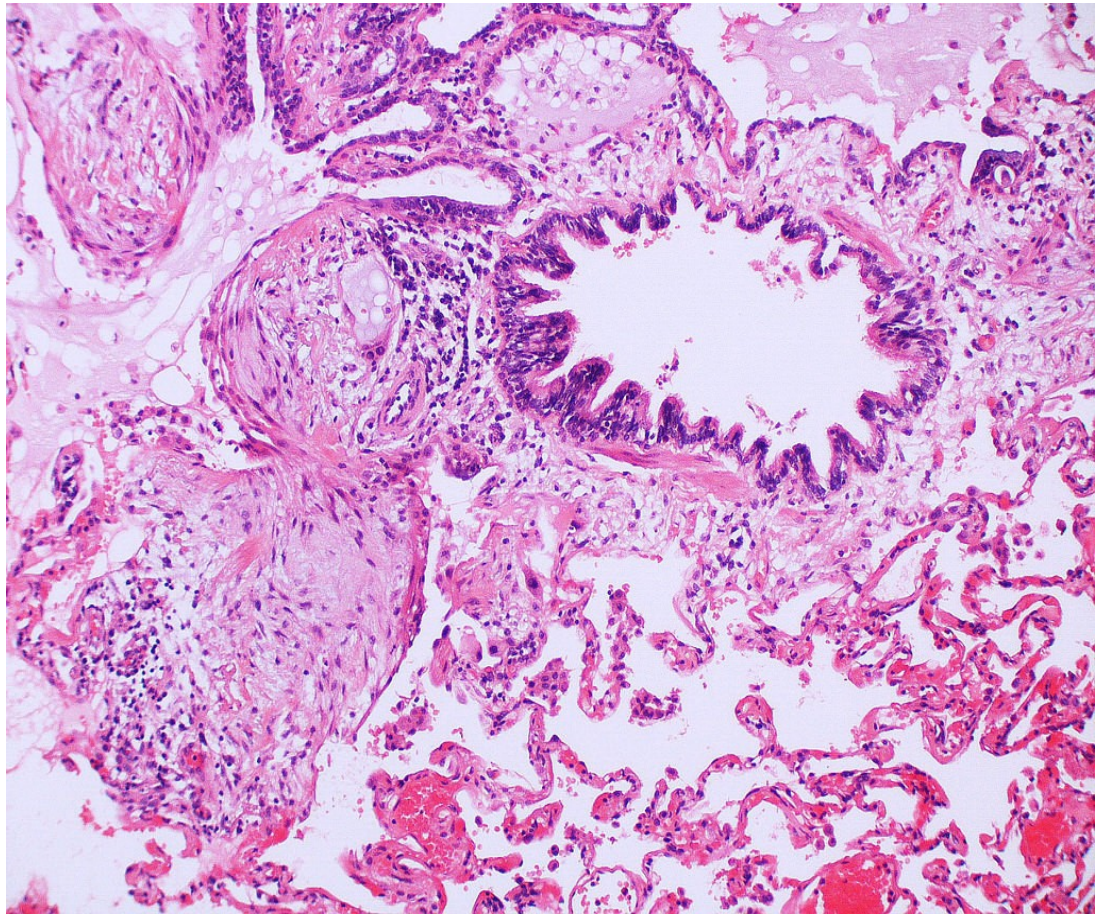
Interstitial Pneumonia

Microscopically:

- Inflammatory reaction is confined to *the walls of the alveoli*.
- The septa are widened and edematous with mononuclear inflammatory infiltrate composed of lymphocytes, histiocytes and plasma cells.
- In contrast with bacterial pneumonias alveolar spaces

  are free of cellular exudates.

  -
- Diffuse alveolar damage with hyaline membrane can occur.



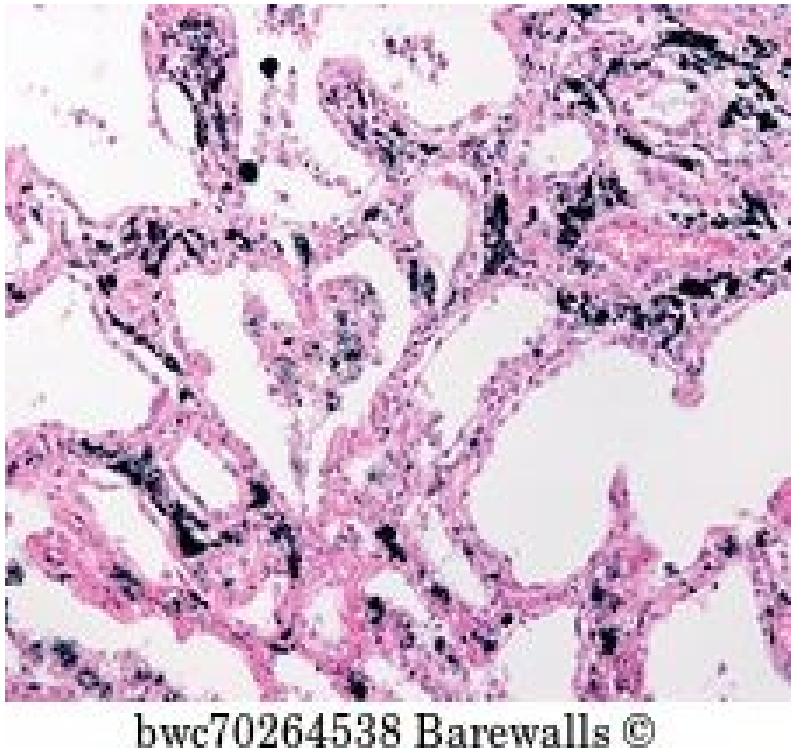
https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwiBx5OH0uPjAhVRzRoKHSNkAScQjRx6BAgBEAQ&url=http%3A%2F%2Fwww.pathologyoutlines.com%2Ftopic%2FlungnontumorUIP.html&psig=AOvVaw2PzKY-INm0HpAUUK0w6u_6&ust=1564815737552708

Pneumoconiosis

Definition: group of chronic lung diseases caused by inhalation of dust pa

Anthracosis:
Inhalation of carbon particles. The carbon particles are removed from the alveoli by macrophages. Anthracosis is non collagenous pneumoconiosis. The affected lung and draining lymph nodes are black in color.

https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwj6z9PV3uPjAhVkx4UKHYeLAPIQjRx6BAgBEAQ&url=https%3A%2F%2Ffineartamerica.com%2Ffeatured%2Fanthracosis-of-the-lung-medimagescience-photo-library.html&psig=AOvVaw3L356v30QRtdvP0tiUTXao&ust=1564819935310673



https://www.google.com/url?sa=i&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwiLvoma3-PjAhUxyoUKHb_qBj0QjRx6BAgBEAQ&url=https%3A%2F%2Fwww.barewalls.com%2Fposters-art-prints%2Fanthracosis.html&psig=AOvVaw3L356v30QRtdvP0tiUTXao&ust=1564819935310673

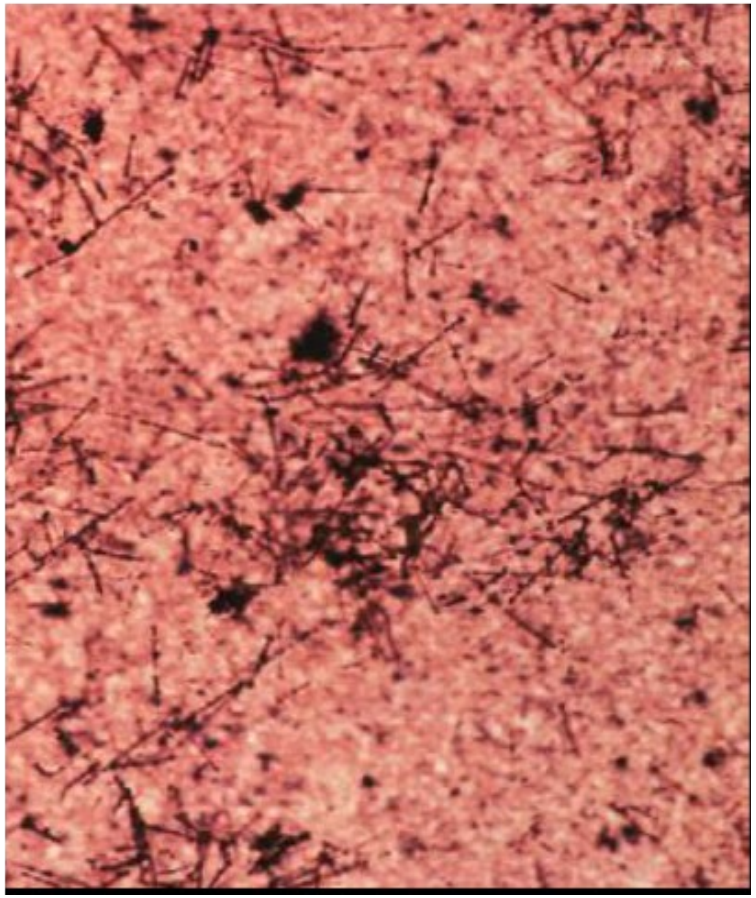
Pneumoconiosis

Silicosis:
inhalation of silica particles causing multiple foreign body granuloma of the lung and fibrosis (collagenous pneumoconiosis).

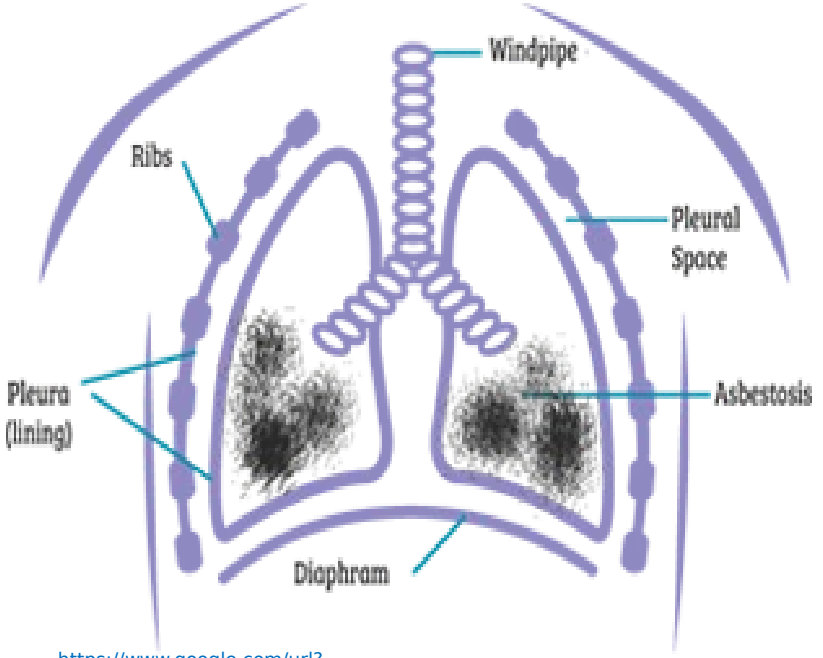
https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwiapeCd4OPjAhVIyxoKHXKXC1sQjRx6BAgBEAQ&url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FSilicosis&psig=AOvVaw3SMBlSNs2sE2dvMFkXSpFX&ust=1564820275728868

Pneumoconiosis

Asbestosis:
Inhalation of asbestos particles which is the most dangerous type and leads to: *mesothelioma, carcinoma of lung, larynx, stomach & colon*.



Kaplan Medical step 1, lecture notes in Pathology: Chapter 14, Respiratory system , pp. 125-143, 2017.



https://www.google.com/url?sa=i&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwj8xqTY4ePjAhXKxIUKHePBD9cQjRx6BAgBEAQ&url=%2Furl%3Fsa%3Di%26source%3Dimages%26cd%3D%26ved%3D%26url%3Dhttps%253A%252F%252Fwww.nationalasbestos.co.uk%252Fasbestos-diseases%252Fasbestosis%252F%26psig%3DAOvVaw2H0cGSJ1PFOvvlWkYQHW1C%26ust%3D1564820672375489&psig=AOvVaw2H0cGSJ1PFOvvlWkYQHW1C&ust=1564820672375489

Pneumoconiosis

Siderosis:

Inhalation of iron oxide, usually in the iron-mining workers.

Bagassosis:

Due to inhalation of bagasse organic dust (moldy molasses).

Byssinosis:

Due to inhalation of cotton dust.

Berylliosis:

Due to inhalation of beryllium dust.

Acute Respiratory Distress Syndromes (ARDS)

Definition: it is a clinical syndrome caused by diffuse alveolar capillary and epithelial damage.

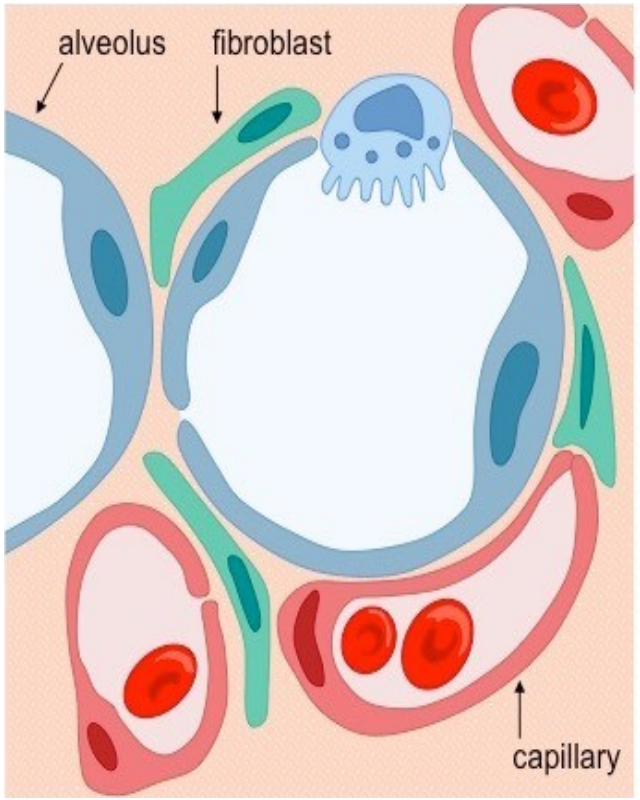
1-Neonatal respiratory distress syndrome: (Hyaline membrane disease) is the most common cause of RDS in the newborn.

Etiology: prematurity, cesarean section, maternal diabetes

The surfactant is a mixture of protein and lipids, produced by type ***II pneumocytes.***

It reduces the surface tension within the alveoli so that less pressure is required to hold the alveoli opened during inspiration and preventing collapse during expiration.

Types of pneumocytes



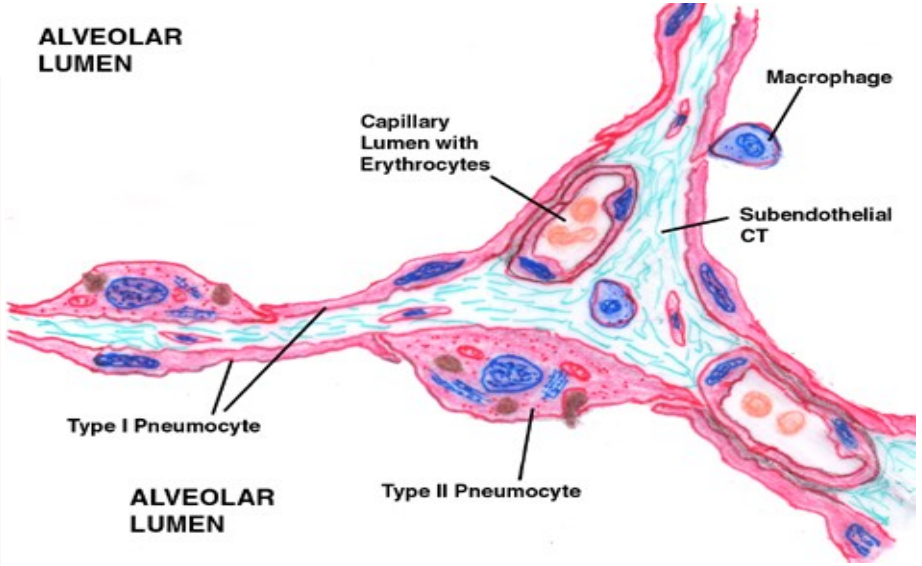
Alveolar Cells

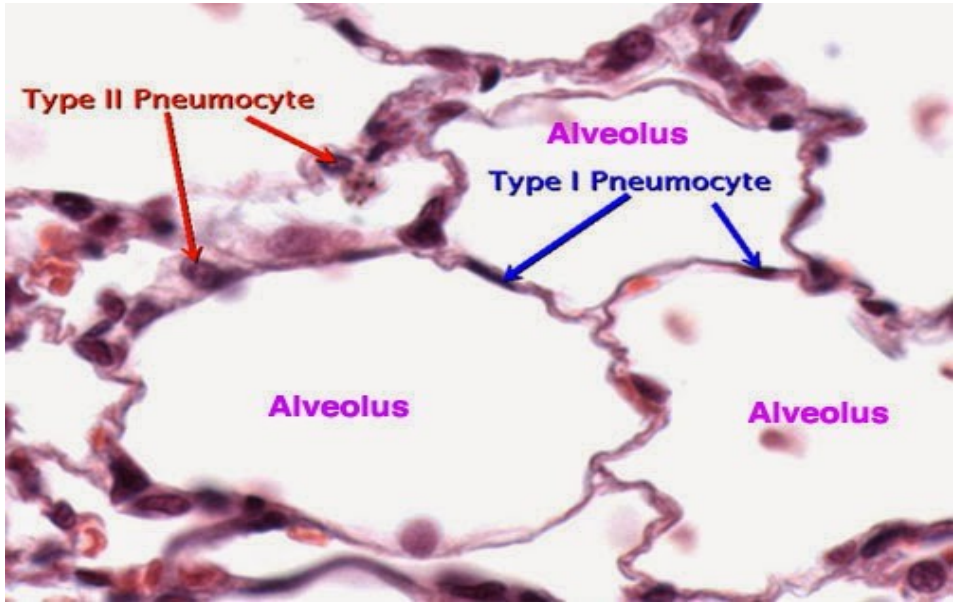
Type I Pneumocyte

- Squamous and extremely thin
- Cover ~95% of alveolar surface
- Involved in gas exchange

Type II Pneumocyte

- Granular and roughly cuboidal
- Cover ~5% of alveolar surface
- Secrete pulmonary surfactant





https://www.google.com/url?sa=i&url=http%3A%2F%2Fib.bioninja.com.au%2Fstandard-level%2Ftopic-6-human-physiology%2F64-gas-exchange%2Fpneumocytes.html&psig=AOvVaw131gKpHnzsnG1zyML15QhB&ust=1595929025115000&source=images&cd=vfe&ved=0CAIQjRxqFwoTCOjknoeR7eoCFQAAAAAdAAAAABADhttps://www.google.com/url?sa=i&url=http%3A%2F%2Foczoo14tcederwall.blogspot.com%2F2014%2F11%2Fcells-

https://www.google.com/url?sa=i&url=https%3A%2F%2Fbeyondthedish.wordpress.com%2F2011%2F11%2F21%2Fintegrin-%25CE%25B16%25CE%25B24-identifies-an-adult-lung-stem-cell-population-with-regenerative-potential%2F&psig=AOvVaw131gKpHnzsnG1zyML15QhB&ust=1595929025115000&source=images&cd=vfe&ved=0CAIQjRxqFwoTCOjknoeR7eoCFQAAAAAdAAAAABAk

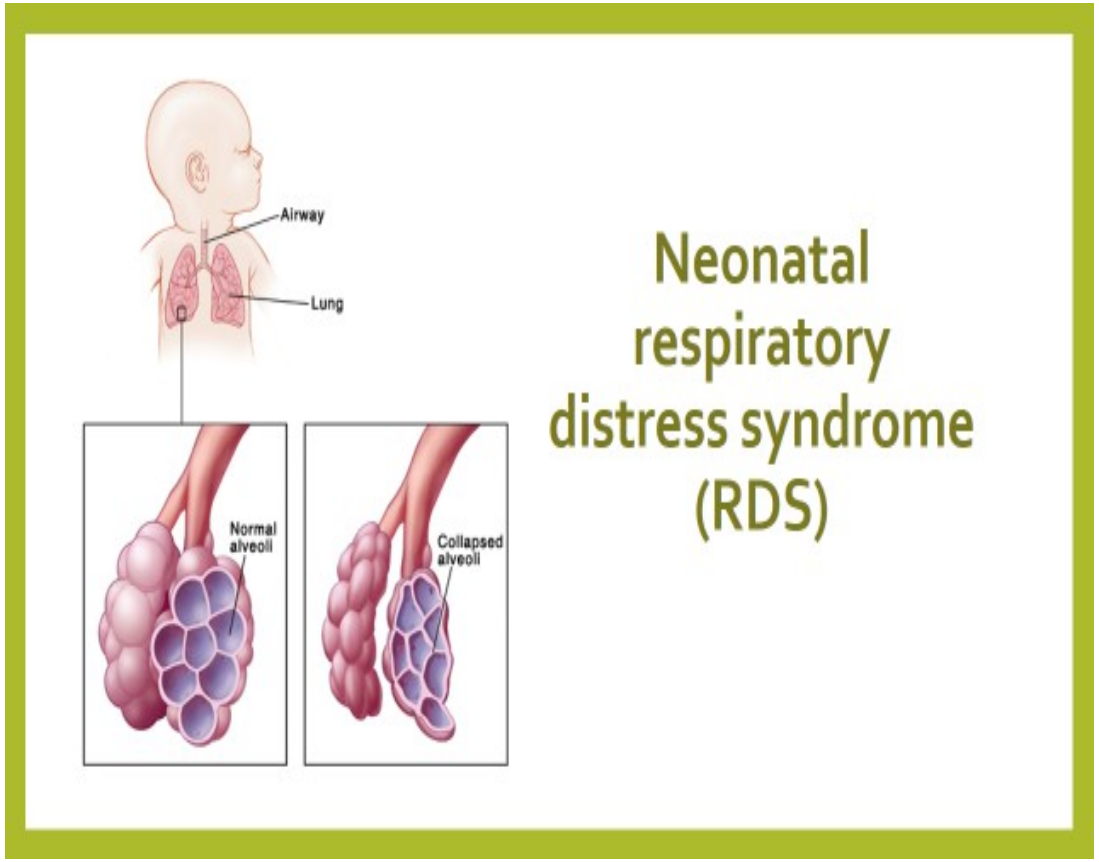
pneumocytes.html&psig=AOvVaw131gKpHnzsnG1zyML15QhB&ust=1595929025115000&source=images&cd=vfe&ved=0CAIQjRxqFwoTCOjknoeR7eoCFQAAAAAdAAAAABAX

1-Neonatal respiratory distress syndrome

Grossly: formation of membrane in the peripheral air spaces.

Microscopically: the lungs show **atelectatic alveoli** and there is a **hyaline membrane** lining the respiratory bronchioles, alveolar ducts and few alveoli.

Clinical effects: marked dyspnea and cyanosis shortly after birth that may progress to



https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwi_kYzi2-PjAhXRxoUKHUC7CMQQjRx6BAgBEAQ&url=http%3A%2F%2Fwww.biosciencenotes.com%2Fneonatal-respiratory-distress-syndrome-rds%2F&psig=AOvVaw1ZupzYHa3tiYIfa85l1T6o&ust=1564819156627827

Adult respiratory distress syndrome-2

Etiology: occurs as a complication of numerous conditions including:

- Diffuse pulmonary infections
-Inhalation of toxins and irritants
- Aspiration of gastric contents
-Head injury
- Heroin over dose
- Oxygen toxicity.
- Mechanical trauma with pulmonary contusions

Complication of ILD

1- Pulmonary hypertension
2- Acute exacerbation of plumonary fibrosis
3- Respiratory infection
4- Acute coronary syndrome
5- Thrombo-embolic disease
6- Lung cancer

Vascular Disorders of the lung

1- Pulmonary edema:

Definition: is a condition in which fluid accumulates in the lungs.

It may be acute or chronic.

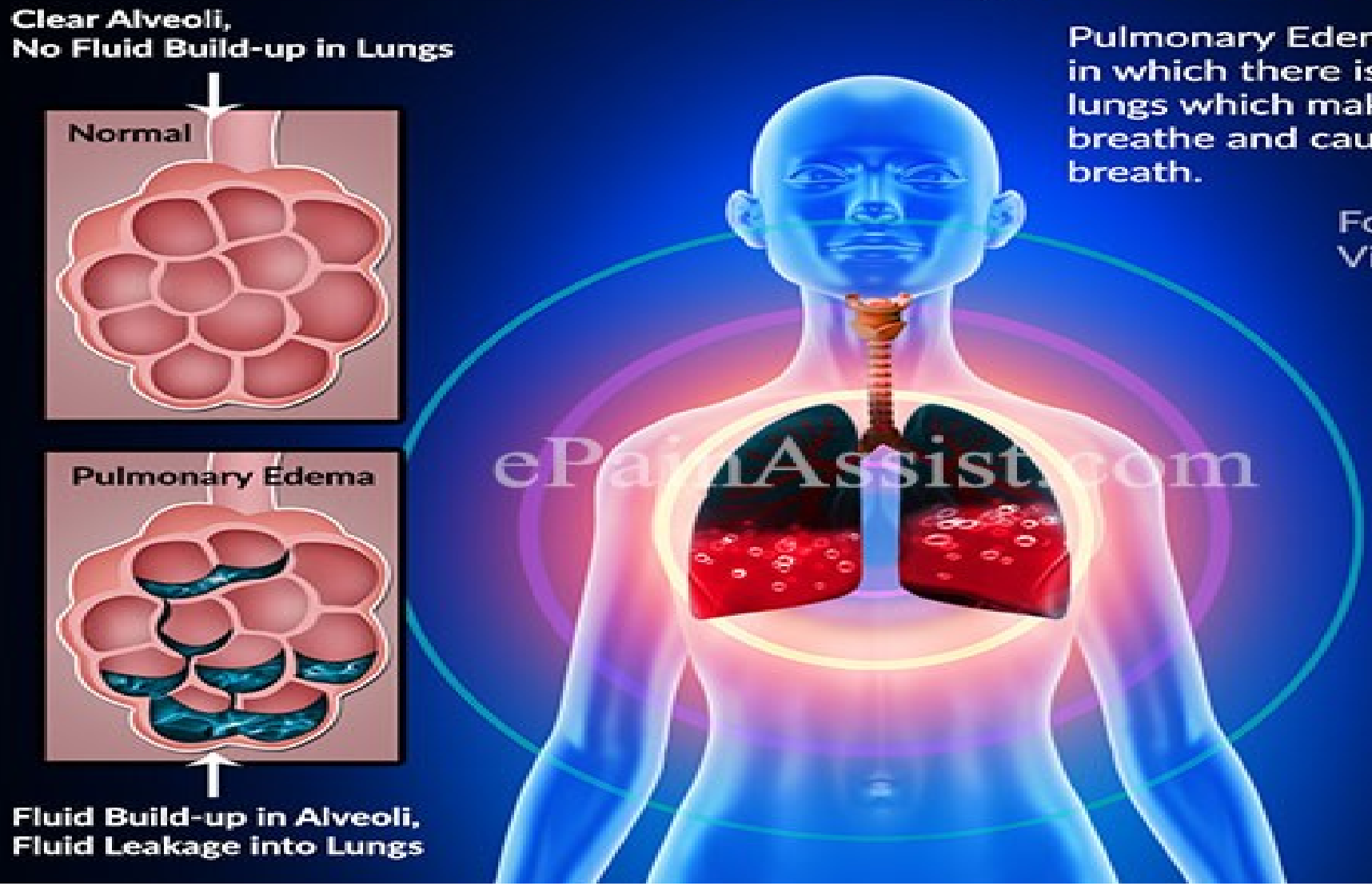
Causes of acute pulmonary ed

1- Inhalation of irritant gases.
2- Following rapid aspiration of pleural
3- Acute influenzal pneumonia.
4- Rapid and massive intravenous infusions.
5- Left-sided heart failure.
6- High altitudes.

Causes of chronic pulmonary edema:

1- Chronic venous congestion of the lung.
2- As a part of generalized edema.

Pulmonary Edema



https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwj0nqmj5-PjAhVRXRoKHRsSCcwQjRx6BAgBEAQ&url=https%3A%2F%2Fwww.epainassist.com%2Fchest-pain%2Flungs%2Fpulmonary-edema&psig=AOvVaw1SmFBZrSuDDkMqMDqtvdgD&ust=1564822169824894

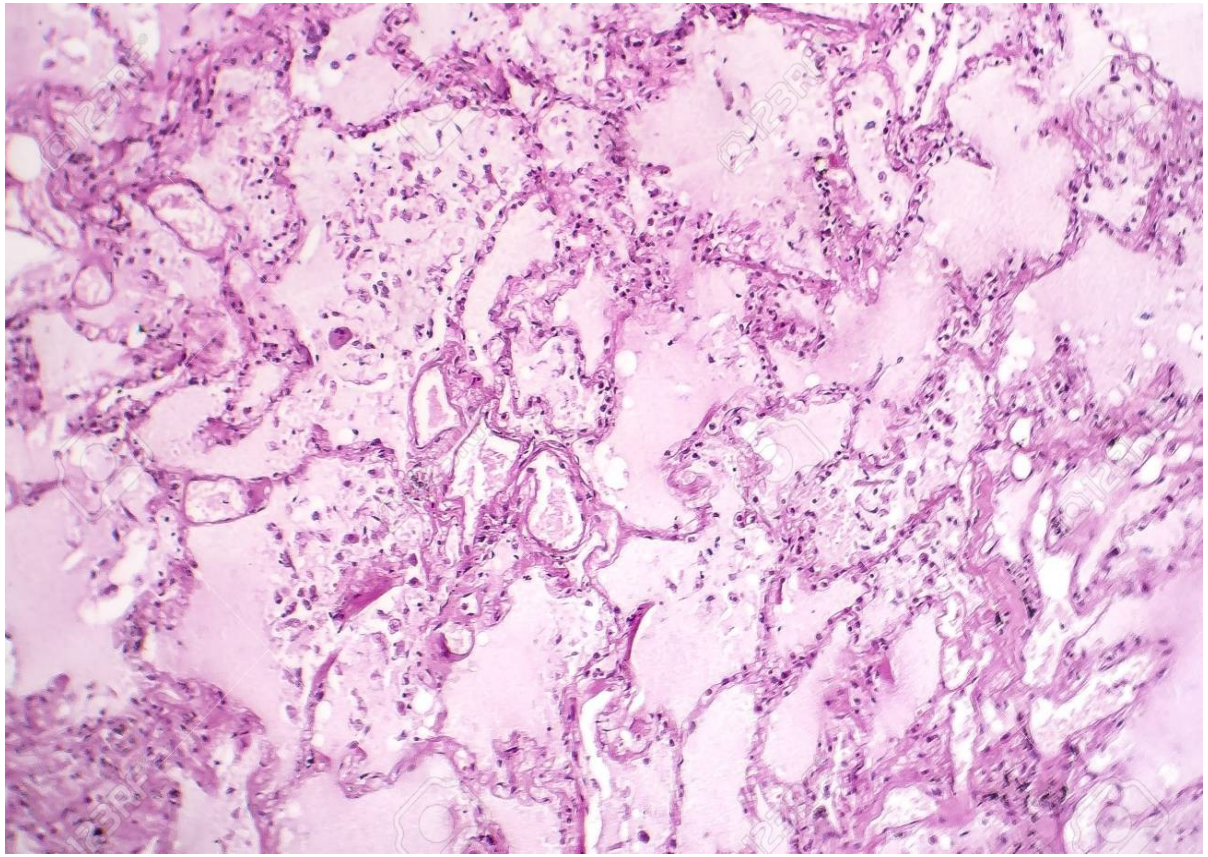
Pulmonary Edema

Grossly:

The lungs are pale, heavy, and bulky and pit on pressure. The cut surface oozes frothy fluid on pressure.

Microscopically:

There are inconspicuous alveolar vessels. The bronchi, air spaces and interstitial tissue contain a pale pink homogenous substance which is a coagulated protein.



https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwj25ofA6OPjAhVGzhoKHZQQBZwQjRx6BAgBEAQ&url=https%3A%2F%2Fwww.123rf.com%2Fphoto_104372503_histopathology-of-acute-pulmonary-edema-light-micrograph-showing-accumulation-of-fluid-inside-alveol.html&psig=AOvVaw0h4KHkuUJKvEofqPRCh8-4&ust=1564822572552756

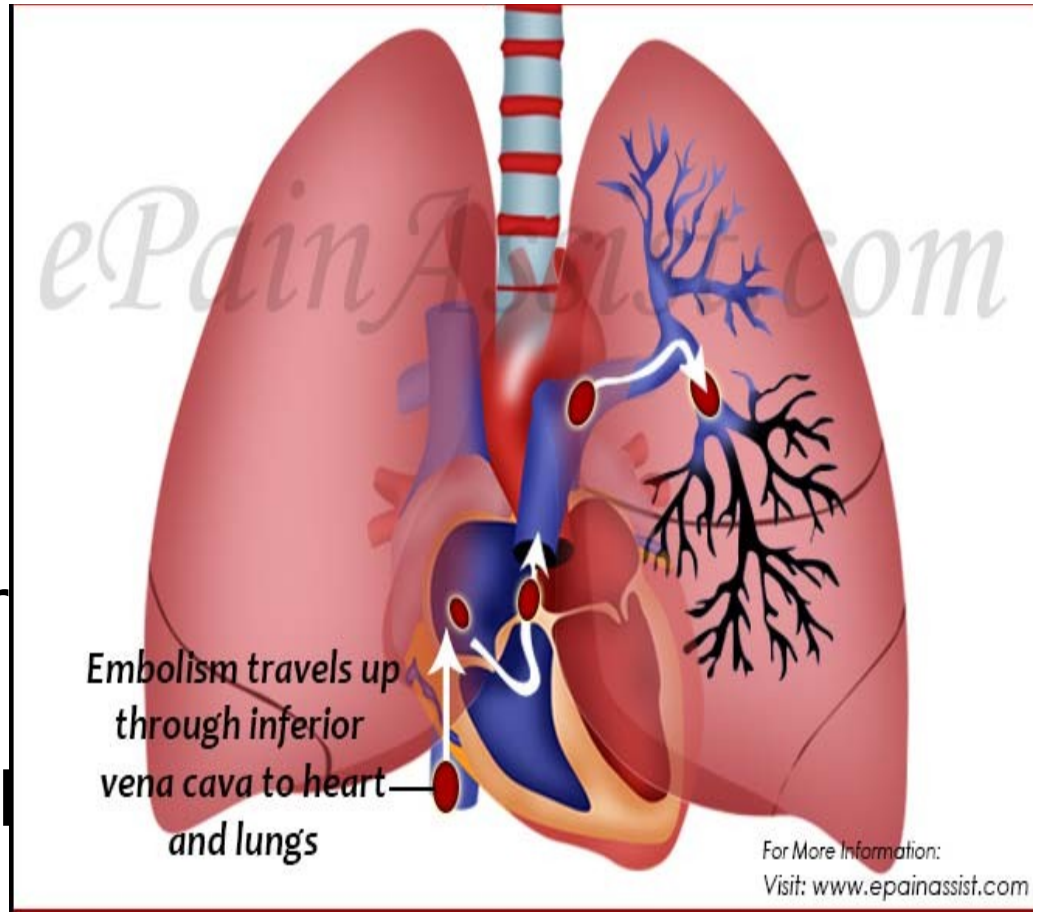
Vascular Disorders of the lung

2- Pulmonary embolism:

Blood clots that occlude pulmonary arteries are almost always embolic i

Causes and source of emboli:

1- Prolonged bed rest
2- Surgery specially orthopedic surg
3- Severe trauma (burns and fractur
4- Congestive heart failure
5- Hypercoagulability states as post
and contraceptive pills intake.
6- Disseminated cancer



https://www.google.com/url?sa=i&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwiw2tCzrufjAhWq4YUKHeldBbQQjRx6BAgBEAQ&url=https%3A%2F%2Fwww.epainassist.com%2Fchest-pain%2Flungs%2Frisk-factors-for-pulmonary-embolism-or-pe&psig=AOvVaw1iIWFdGBKsdsLa5K4PQ_bC&ust=1564944396167865

Vascular disorders of the lung

7- Lower limb varicosities.

The consequences of pulmonary thromboembolism depend largely on the size of the embolus and the cardiopulmonary status of the patient

A- **Large embolus** inside the main pulmonary artery and its bifurcations ***(saddle embolus)*** causes sudden death due to right sided heart failure and no time for morphologic changes in the lung.

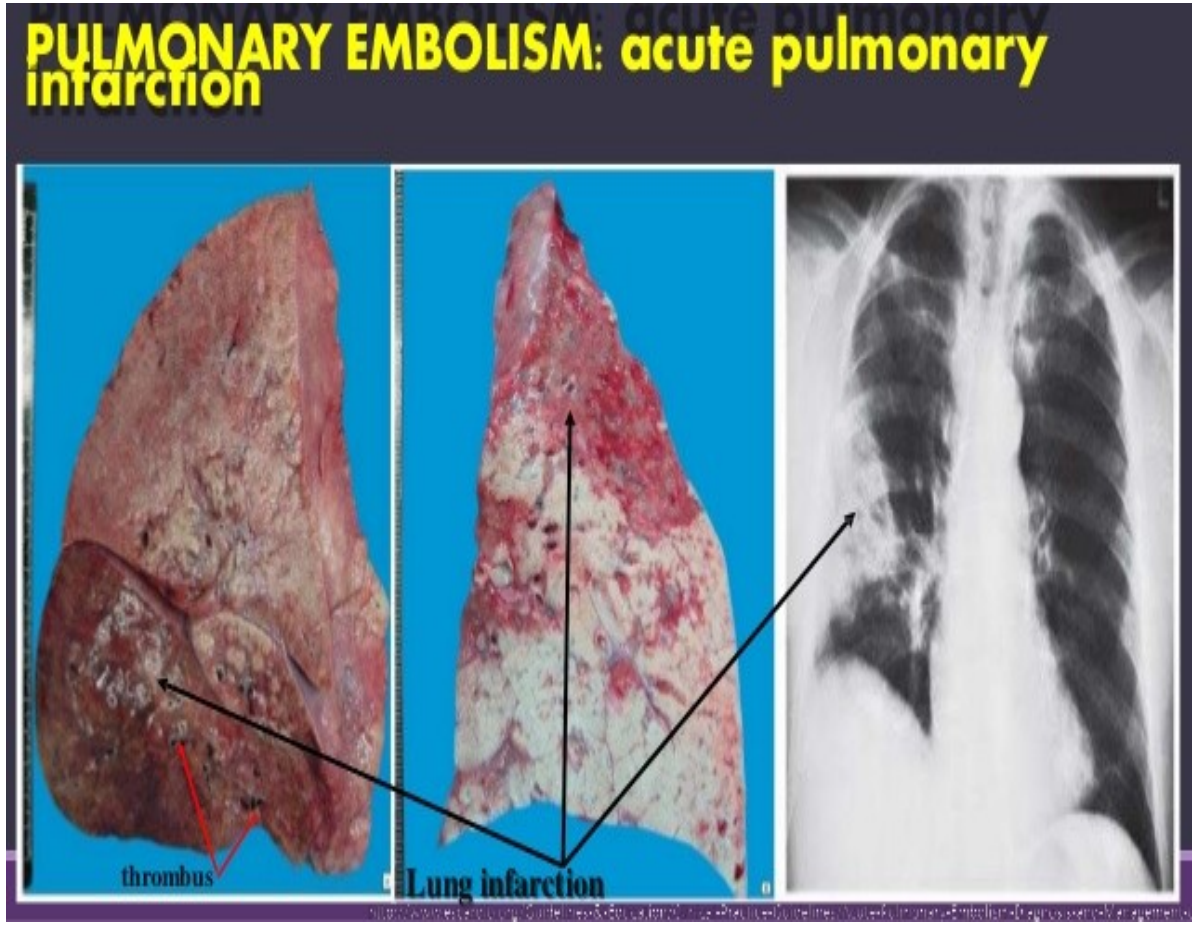
B- Small embolus with adequate circulation : the vitality of lung parenchyma is maintained(no infarction)but alveolar hemorrhage may occur .

Vascular Disorders of the lung

3. Pulmonary Infarction

occurs if embolism occurs with compromised cardiovascular status as in **congestive heart failure and chronic venous congestion (CVC) of the lung.**

The infarct appears as wedge shape with the base towards the pleura and the apex towards the hilum and typically hemorrhagic in appearance. The covering pleura has fibrinous exudates.



https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwjJjc2TsefjAhVMQBoKHdgbB8sQjRx6BAgBEAQ&url=https%3A%2F%2Fwww.slideshare.net%2FE_neutron%2Fpulmonary-embolism-77825110&psig=AOvVaw3FIZ9thJdyFWaXRCqaSnr-&ust=1564944995095302

Vascular Disorders of the lung

4- Pulmonary hypertension:

Definition: Pulmonary pressure reaches one fourth or more of the systemic level.

Causes :

A- Chronic obstructive or interstitial lung diseases accompanied by destruction of the lung parenchyma and reduction in the alveolar capillaries.

B- Recurrent pulmonary emboli with reduction in the pulmonary vascular bed.

C- Heart diseases as mitral stenosis and congenital left to right shunt.

Lecture Quiz

1- Fill in the space:

Interstitial lung disease concerns with affection of

a.....

b.....

c.....

2- Write true or false

Interstitial lung disease ends by massive fibrosis even carcinoma of the lung

3- define pneumoconiosis and **list** four types

SUGGESTED TEXTBOOKS

1- Kaplan Medical step 1, lecture notes in Pathology: Chapter 14, Respiratory system , pp. 125-143, 2017.

2- Hursh Mohan Text Book of Pathology, 7th ed. (2015): Chapter 14, Respiratory system, pp. 442-488.

3- Hursh Mohan Text Book of Pathology, 7th ed. (2015): Chapter 15, eye, ENT and neck, pp. 495-500.

4- Robbins basic of Pathology, 10th ed. (2018): Chapter 13, Lung. pp. 495-549.


Thank You